SOME CONSIDERATIONS REGARDING WOUNDS OF THE LIVER.[1]

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MUCH attention of late years has been devoted to the general consideration of open and subcutaneous injuries of the abdominal viscera, and at the present time the diagnosis, indications for operation, and the operative treatment itself of these injuries are questions that have been fairly well solved, and with regard to which reasonably definite conclusions have been reached.

The determination of the existence of some visceral injury has now become possible in most cases by our present methods of examining the abdomen and noting the changes here as well as the alterations in temperature and pulse. The rule to operate for these injuries within the abdomen has become so definite that we are often inclined to make merely the general diagnosis of a wounded viscus, and then proceed at once to laparotomy without a more definite determination of the particular structure involved. It is the object of this paper to consider the injuries of one particular organ, the liver, and to discuss their special signs, prognosis, and indications for treatment.

Etiology.—The liver is injured with greater frequency than any other solid abdominal viscus. Among 365 cases of subcutaneous injuries of solid viscera, the liver was the seat of injury in 189, and the spleen, kidney, and pancreas combined in 176. There are several factors which make it particularly susceptible to injury, especially in contusions of the abdomen. It lies wedged in between the ribs and vertebral column, is very heavy, very inelastic, and only slightly movable. It is nine times as heavy as the spleen and ten times as heavy as the kidney. Other predisposing factors are added from physiological and pathological causes. Digestion makes it larger and more vascular. Alcoholism, tuberculosis, malarial conditions, and tumor formation render it more friable and exposed to injury. In the presence of any one of these conditions a very slight traumatism may suffice to produce a subcutaneous rupture of the organ with fatal outcome. Chiari reports a case of rupture of a carcinomatous liver simply from turning over in bed. Heinzelman that of the sudden death of a patient from rupture of the liver who two weeks before had had pneumonia followed by pleurisy. In the following case, which recently came under my own observation, the etiology of the injury to the liver was very obscure:

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CASE I.—A man, twenty-seven years of age, was admitted to the prison ward at Bellevue Hospital, September 20 of this year, suffering from what was thought to be alcoholic delirium. A history was later obtained from his family that he had been ill for three weeks. There was no history or mark of traumatism. On admission his temperature was 100.2° F.; pulse, 120, and respirations, 26. The leucocyte count was 15,000. He was markedly alcoholic in appearance and very delirious. The abdomen was somewhat distended, and there were well-marked rigidity and tenderness on the right side over and below the ribs. The liver extended from the sixth rib above to three inches below the free border. The spleen was not enlarged. A diagnosis was made of probable abscess of the liver.

While operative interference offered but little hope of a favorable outcome on account of the poor condition of the patient, it was decided upon as the only chance for his recovery. An incision was made through the right rectus, exposing a very large, congested, and friable liver. There was an escape of some thin, bloody fluid from the peritoneal cavity, but there was no peritonitis. On inspecting the convex surface of the liver, which was somewhat adherent, a large tear was discovered on the right lobe about six inches in length. The edges for a distance of three inches on either side were necrotic, and loose sloughs of liver tissue could be removed with the fingers. The injured portion of the liver was about to break down and form a superficial abscess. Some of the necrotic tissue was removed, the resulting defect packed with gauze, and the abdomen partially closed. The patient's condition did not improve, the delirium continued, and he died on the third day with a temperature of 103° F.

This seems to have been a case of subcutaneous rupture of the liver in a very alcoholic subject without any history of injury. Some injury undoubtedly occurred, but it was apparently not severe enough to produce signs over the liver region or lesions of other parts of the body. Traumatism was never thought of in making the diagnosis before operation.

The two varieties of wounds of the liver, viz., the subcutaneous and the open, are, according to Edler's statistics, about evenly divided. Of the open injuries, gunshot wounds were nearly twice as common as stab wounds. These figures will, of course, vary in different countries and localities. The ribs, however, offer more protection from stab wounds than from those produced by a bullet. Subcutaneous injuries are very common in children, especially in the large cities, where they are exposed to run-over accidents and falls from high tenement houses, fire-escapes, etc.

As far as the portion of the liver involved is concerned, we find that in subcutaneous injuries the right lobe is injured about six times as frequently as the left, and the convex surface about twice as often as the concave. In stab wounds, on the other hand, the left lobe is the more frequently injured, owing to the fact that it is less protected by the ribs than the right.

Wounds of the liver are very frequently associated with injuries of other organs. Probably no organ has as many complicating injuries. In subcutaneous rupture very common associated injuries are those of the lung, spleen, kidney, gastro-intestinal tract, and bile ducts. Injuries of distant parts, such as fractures of the skull, spine, and extremities, often accompany ruptures of the liver. In this case the latter are frequently due to violence by contra-coup. Thus, a man falling from a height upon the head or feet fractures the skull or extremities, and the liver by indirect violence is torn from its attachments or forcibly pressed against the contracted diaphragm. Among 151 cases of subcutaneous rupture collected by Hinzelman, one-third were produced by indirect violence.

Gunshot wounds and stab wounds are found associated many times with perforation of the diaphragm, lung, stomach, or intestines, and kidney. The presence of these complicating injuries increases very materially the gravity of the prognosis and renders our operative interference much less hopeful.

The following case of gunshot wound of the liver had a rather unusual feature:

Case II.—A man, twenty-five years of age, was admitted to Bellevue Hospital in August, 1900, with a history of having been shot in the abdomen by a pistol of .32 caliber. The wound of entrance was to the right of the median line near the free border of the ribs. There was no exit opening. There was some shock, but no signs of internal hæmorrhage. Laparotomy showed two openings in the liver, one on the convexity, the other on the under surface. These wounds had caused only slight hæmorrhage. No other wounds were found, although the intestines and stomach were carefully examined. The wounds in the liver were covered by strips of gauze, which were brought out through the abdominal incision. During the convalescence the dressings were stained with bile for several days. Six weeks after the injury the patient complained of pain about the rectum, and examination showed a small ischiorectal abscess. This was incised, and inside of it was the .32-caliber bullet. In all probability, the bullet entered the intestine either at the time or by ulceration, and then remained in the rectum, where it ulcerated through the mucous membrane, causing the abscess. Otherwise the recovery was uneventful.

Symptoms.—In determining the existence of a wound of the liver, we have usually a number of factors of more or less diagnostic aid. In subcutaneous wounds there may be signs of local injury of the overlying parts. Ecchymosis of the skin or fractures of ribs may turn our attention towards the liver as the injured organ. In gunshot wounds there will be a wound of entrance usually over the liver, and if there is a wound of exit, the direction taken by the bullet may determine whether the liver has been perforated. Escape of venous blood with or without an admixture of bile are important positive signs, particularly in stab wounds. Localized pain over the liver which is intensified by pressure or percussion is usually present. Pain radiating to the right shoulder is suggestive of injury of the liver, and has been noted in a number of cases. The pain in the liver region is intensified by respiration, and hence the right chest does not move as freely as the left. In consequence, a false diagnosis may be made of intrathoracic injury. Terrier reports such a case in which a thoracotomy was done, and the autopsy showed the injury to be a rupture of the liver, with a large accumulation of blood in the abdomen.

Hæmorrhage being an important and constant accompaniment of wounds of the liver, symptoms of the same, both local and general, are usually present. In severe injuries, especially subcutaneous ruptures, the general signs of hæmorrhage are well marked, but are not always easy to differentiate from the symptoms of severe shock that accompany these injuries. The accumulation of blood in the abdomen can frequently be demonstrated by percussion. Rigidity of the abdominal muscles may, however, render this a difficult task. The blood gravitates into the right iliac fossa and may give well-marked dulness. The *diffusion* of blood causes, furthermore, gradually increasing pain from pressure, and this is often a characteristic sign of rupture of a vascular organ. Disappearance of liver-dulness due to beginning tympanites may come on in a few hours, and should not lead to a false diagnosis of a ruptured hollow viscus. When due to escape of gas from a ruptured intestine, this disappearance of the liver-dulness comes on immediately after the injury. Later on the area of liver-dulness is *increased* from a resulting hepatitis.

Jaundice is occasionally present after injuries of the liver, but usually does not appear until the second to the fourth day. It is caused by absorption of bile from the peritoneum. Ludwig found it twenty-four times in 267 cases. It is very frequent after injuries of the bile passages. In case of subsequent inflammation or abscess formation in the liver, a secondary jaundice may occur days or weeks afterwards.

The escape of blood and bile into the peritoneal cavity may result either in an acute septic peritonitis or a chronic plastic peritonitis with adhesions. The blood coming from the portal circulation varies in its infectious character. This depends somewhat upon the condition of the gastro-intestinal tract at the time of injury. The same is true of the bile; that from the common duct is more dangerous than that from the liver itself. The onset of this acute peritonitis may be very gradual. Open injuries may, of course, cause direct infection from the outside or by means of a foreign body.

The signs which accompany any visceral injury are usually well marked in case of injuries of the liver. The rigidity of the abdominal muscles is a never-failing symptom. It may be confined to the region over the liver. Vomiting and hiccough are not uncommon, and are due to the peritoneal irritation. A rise of temperature usually takes place from absorption of blood from the peritoneum. The rise of temperature due to peritonitis occurs at a later period, usually the second to the third day.

Prognosis.—The prognosis of injuries of the liver depends largely upon the associated injuries and the complications. The severest cases die within twenty-four hours from shock or hæmorrhage. These cases are hopeless from the start, and there are frequently injuries of other organs. The promptest operative interference will not be able to lessen the mortality of these severe cases. Of 162 fatal cases collected by Edler, hæmorrhage was the direct cause of death in sixty-nine. Generally speaking, the prognosis of injuries of the liver alone is much better in the gunshot and stab wounds than in the subcutaneous ruptures. The hæmorrhage in the former is less severe and the shock less marked. Apart from hæmorrhage and shock, the complications due to infection influence the prognosis very materially. Acute peritonitis and abscess of the liver are responsible for many deaths. Even in subcutaneous injuries, accidental infectiousness of the bile or of the blood from the portal system may cause suppurative peritonitis. Furthermore, the contused wound of the liver may offer a favorable location for the development of an abscess, particularly if the blood circulating in the liver is infected or the resistance of the tissues is much lowered. A long period may elapse before the fatal outcome. Even a plastic peritonitis may cause a fatal result from obstruction of the intestine by adhesions.

There are many mild cases of laceration of the liver which go on to recovery without complications and with very few symptoms. The number of these cases is, I think, larger than is generally supposed. They often go unrecognized, and the person recovers with a diagnosis of severe contusion of the abdomen without visceral injury. The present tendency to make an exploratory laparotomy in severe contusions of the abdomen which show signs of muscular rigidity and which are suspected of being complicated by a visceral rupture occasionally brings to view a mild laceration of the liver, especially of the convex surface, with very moderate hæmorrhage. Such cases have an excellent prognosis, and recovery will usually result whether they are operated upon or not. If these mild cases in which there are one or more superficial ruptures were included in the statistics, the mortality percentage would be a great deal lower than it is at present.

In 1887, Edler's statistics showed a mortality in subcutaneous ruptures of 78.1 per cent.; gunshot wounds, 39.0 per cent.; stab wounds, 37.5 per cent. This mortality, particularly of subcutaneous injuries (78.1 per cent.), seems much higher than at the present time, and this, if true, is probably due to earlier recognition and earlier operation. The recent statistics of Terrier and Auvray covering forty-five cases, all of which were operated upon, represent much improved mortality statistics. Among eleven cases of rupture five died, a mortality of 45.5 per cent. Among fourteen gunshot wounds four died, a mortality of 28.3 per cent., and among twenty stab wounds five died, a mortality of 25 per cent. The mortality of all the cases was 30 per cent. against the total mortality in Edler's statistics of 66 per cent. Like all statistics of operative cases, these of Terrier and Auvray may be objected to on the ground that the successful ones are more likely to be published than the unsuccessful. They show, however, that with early diagnosis and prompt operative treatment much can be accomplished in lowering the very high mortality which the severer forms of wounds of the liver have had in the past. By collecting cases from hospital records and not from published sources, a more accurate idea can be obtained of the mortality of these injuries under present methods of treatment. I have made such a collection, excluding cases that were complicated by serious lesions of other abdominal organs or of other parts of the body which were clearly responsible in great measure for death. These cases occurred within the last ten years in New York hospitals with large accident services. They are twenty-five in number, and are divided as follows: ruptures, 12; gunshot wounds, 9, and stab wounds, 4. Death occurred in eleven cases, a mortality of 44 per cent. The cases which were treated by early laparotomy were twenty in number, with a mortality of 40 per cent. The mortality among ruptures that were operated upon was 62.5 per cent.; stab wounds, 33 per cent., and gunshot wounds, 28.5 per cent. These statistics are not quite so favorable as those of Terrier, but probably represent more accurately the actual mortality.

Treatment.—As far as the treatment of injuries of the liver is concerned, the modern tendency is towards early laparotomy, as in suspected injuries of any of the abdominal viscera. Open wounds should, without exception, be treated by enlargement of the wound, exposure of the liver, and determination of the site and extent of the injury to the organ. In this way can we alone be sure of excluding or finding associated injuries, removing foreign bodies, stopping hæmorrhage, preventing secondary hæmorrhage, and avoiding infection of the liver or of the peritoneal cavity. Care should be taken to examine the entire liver, as a second wound may remain unnoticed and give rise to fatal bleeding. Many cases of gunshot or stab wounds will doubtless recover by expectant treatment, but other cases will die from some of the above accidents, which could have been discovered or avoided by enlarging the wound. The latter procedure adds littls to the risk if done under favorable conditions, and if more generally employed will result in still better statistics. Some authors still recommend expectant treatment in these cases in the absence of urgent symptoms, such as hæmorrhage, on the ground that these milder wounds not infrequently result favorably without operation. This seems a wrong principle to work on. Many cases might recover without interference, but others will prove fatal from oversight of an intestinal perforation or foreign body, or from insufficient drainage of the wound in the liver.

The indications for operation in subcutaneous injuries are not so definite. In the absence of distinct signs of hæmorrhage, of marked rigidity of the abdominal muscles, of dulness in the right iliac fossa, and of increasing abdominal pain, an expectant attitude seems justified, even though the nature of the injury and the presence of shock point to some degree of laceration of the liver. The fact that these slight ruptures heal without incident has been abundantly proved by exploratory laparotomies where they have been found, the abdomen closed without further interference, and the patient gone on to prompt recovery. The lesions of the liver are circumscribed and not deep, the amount of hæmorrhage is slight, no bile-ducts are torn, and the risk of peritonitis is at a minimum. Under these conditions, the unnecessary exposure of the liver adds considerably to the risk; what was a mild subcutaneous injury is converted into an open one with all its possible consequences. In very young and weakly subjects the added shock of an exploratory laparotomy may turn the scale against the patient.

Matters are very different in the severer cases with well-marked and progressive symptoms of internal hæmorrhage, peritoneal irritation from accumulating blood, dulness in the iliac fossa, and that very important and never-failing rigidity of the abdominal muscles associated with a severe visceral rupture. Here the surgeon has no choice, and he must operate to stop hæmorrhage. Furthermore, it is imperative to examine for the associated injuries of other viscera which so frequently accompany severe ruptures of the liver. In order to expose satisfactorily wounds of the convexity of the liver, it may be necessary to divide the lower ribs or cut the suspensory ligament.

The best methods of stopping hæmorrhage are by the use of sutures or gauze packing. If the former are used, they should include considerable liver tissue at the edges of the wound, and if possible go down to its full depth. Blunt needles as recommended by Mikulicz and Kader seem well adapted for suturing. Gauze packing is particularly suitable for contused wounds, gunshot wounds, and punctured wounds, and is, furthermore, a useful addition to suture. The thermocautery is of very little value in arresting hæmorrhage from the liver. The blood and bile can easily be removed by flushing the abdomen with hot saline or by dry sponging, according to the preference of the operator. Drainage is employed in subcutaneous wounds chiefly for the purpose of arresting hæmorrhage. In gunshot and stab wounds with a dirty instrument, it is a valuable means of preventing local infection of the organ or general infection of the peritoneal cavity.

The following conclusions seem to be justifiable. The prognosis of the severer cases of wounds of the liver alone has improved of late years, especially under early operative treatment. Many cases must necessarily, of course, be promptly fatal from shock or hæmorrhage or from associated injuries of other organs. Many others can be saved by operation which would otherwise die from hæmorrhage or some complication. The treatment of all open injuries should be early laparotomy for the purpose of hæmostasis, thorough examination, and prevention of infection. As regards subcutaneous ruptures, the mild cases without marked symptoms of collapse or internal hæmorrhage should be treated expectantly. Cases in which there are marked collapse or signs, local or general, of internal hæmorrhage should be treated by early laparotomy, with suture or packing of the wounded liver. The mortality of wounds of the liver alone will in all probability diminish from year to year with the more general adoption of early laparotomy.

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